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Food & Nutrition Research Briefs

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Deficiency Prompts Virus to Mutate

A human virus normally harmless in laboratory mice mutated into a heart-damaging pathogen when the animals were raised on a diet devoid of selenium. And, once mutated, the virus continued to damage hearts—even in mice that got ample selenium in their feed. The findings are the first indication that a nutritional deficiency can cause a virus to mutate to a more virulent form. And its importance is not limited to nutritionally-deprived populations, say researchers with the University of North Carolina and ARS who collaborated on the studies. In theory, one selenium-deficient person or animal could produce a new family of virus mutants that could cross species and spread worldwide, causing disease even in well-nourished people.

ARS researchers supplied the nutritional expertise and diet. UNC researchers found six sites on the coxsackie B3 virus genome that were permanently altered after it had spent time in selenium-deficient mice. Coxsackie viruses, as a group, infect more than 20 million people in this country annually, producing a range of maladies from sore throat and cold symptoms to inflammation of the heart muscle. About 10 percent of infected people develop serious diseases, including heart muscle inflammation.

Other nutritional deficiencies can also cause viral mutations, it appears. UNC researchers are now analyzing the genes of coxsackie B3 virus that damaged hearts in vitamin-E-deficient mice. They expect to find the same alterations as with selenium deficiency. Both nutrients serve as antioxidants in the body. If such mutations occur in other RNA viruses, they may help explain the many new strains of influenza virus arising in China, which has widespread selenium-deficient areas. *For more information, contact Melinda A. Beck, (919) 966-6809, Frank Porter Graham Child Development Center, University of North Carolina, Chapel Hill, NC; or Orville A. Levander, (301) 504-8504, Beltsville Human Nutrition Research Center, Beltsville, MD.*

Antioxidants Vs. Sunburn

Large oral doses of vitamin E or beta carotene do not appear to prevent sunburn or damage to skin cells that can lead to photo-aging and skin cancer. But preliminary evidence suggests that lycopene—a relative of beta carotene—might help reduce the damage caused by the sun's ultraviolet (UV) rays. That's the finding in two separate

studies. Researchers wanted to resolve conflicting evidence that antioxidant vitamins taken by mouth protect the skin against oxidizing agents generated by the sun's rays.

In one study of 12 men and women, small areas of skin were exposed to a burning dose of UV radiation after the volunteers had taken either 400 International Units (IU) of vitamin E or a placebo daily for six months. The supplement did not significantly increase skin levels of vitamin E. And it did not reduce skin redness or cell damage compared to volunteers who didn't get the real thing.

In another study of 16 women, half of whom took beta carotene supplements, skin levels increased. But this did not prevent sunburn. They were similarly exposed to UV radiation after taking one 120-milligram beta carotene supplement—10 times the amount in most supplements—and again after taking a 90-mg supplement daily for three weeks. Skin levels of beta carotene didn't decrease after UV radiation, indicating the nutrient was not being used to protect against sun damage.

By contrast, skin levels of lycopene dropped significantly after UV radiation. Researchers could not test the effects of giving extra lycopene, however, because supplements were not available when the study was done. Lycopene is the red pigment that colors tomatoes, watermelons and pink grapefruit. *For more information, contact Judy D. Ribaya-Mercado, (617) 556-3128, about the beta carotene/lycopene study; or Mohsen Meydani, (617) 556-3126, about the vitamin E study, USDA Jean Mayer Human Nutrition Research Center on Aging at Tufts, Boston, MA.*

Selenium Lifts Spirits, Lowers Metabolism

Selenium—the essential trace element known for its antioxidant prowess—also appears to lift the spirits, according to a study of mood changes under high and low intakes. During the 15-week study, 30 men reported significant changes in two of six moods, as measured by a standard questionnaire. The 15 men who consumed nearly 3.5 times the daily recommended selenium intake felt significantly more clearheaded and elated toward the end of the study than they did at the outset.

Another 15 men consumed only 40 percent of the recommended intake. Within that group, researchers found differences in all six moods based on the activity of a selenium-containing enzyme in the men's blood platelets. This is one indicator of how much selenium is available in the

body. The men with the more active enzymes felt more agreeable than hostile, more clearheaded than confused, more composed than anxious, more confident than unsure, more elated than depressed and more energetic than tired. That's even though enzyme activity was within the "normal" range for all the volunteers.

The findings agree with another ARS study in which the amount of selenium in men's red blood cells correlated with two of the mood states. A note of caution: Large doses of selenium can be highly toxic. The World Health Organization recommends a daily limit of 400 micrograms—that's millionths of a gram. Good food sources include animal flesh—meat and poultry—seafood and grain products—breads and cereals. *For more information, contact James G. Penland, (701) 795-8471, Grand Forks Human Nutrition Research Center, Grand Forks, ND.*

Meals rich in selenium may alter thyroid hormone activity and result in weight gains, according to ARS findings. That effect might help patients with wasting diseases such as cancer or AIDS. Adding pounds, or at least preventing unwanted weight loss, may be a side benefit of the experimental selenium treatments that some medical researchers have already suggested for both types of patients. However, selenium in amounts 10 times higher than the Recommended Dietary Allowance can be toxic.

Working with 11 male volunteers, researchers found that a regimen which safely provided five times the RDA for selenium caused the men to gain about 1.5 pounds over a 14-week period, despite scientists' efforts to keep everyone's weight stable. The high-selenium stint lowered the body's levels of the T_3 thyroid hormone, which controls the body's calorie-burning rate. Volunteers on the low-selenium program received only about one-fifth the RDA. They increased their levels of T_3 and lost about one pound over the same period.

Researchers already knew that the body needs selenium for converting the precursor compound— T_4 —to T_3 . But they were surprised that their results disagreed with studies, done elsewhere, in which selenium-deficient diets had the opposite effect in lab animals. *For more information, contact Chris Hawkes or Nancy L. Keim, (415) 556-1377, Western Human Nutrition Research Center, San Francisco, CA.*

Potential Drug for Asthma, Atherosclerosis

A newly discovered lipid may join the ranks of drugs that fight inflammation. Such nonsteroidal drugs that are now available—including aspirin, acetaminophen and ibuprofen—inhibit two biochemical pathways in the body. But the new lipid, which could be indirectly produced from agricultural products, inhibits only one—the lipoxin biosynthetic pathway. A drug with these properties would work especially well on inflammatory conditions associated with asthma and atherosclerosis. Pharmaceutical companies have been searching for such a compound. Another plus for the new lipid: It tested negative for fungicidal, herbicidal and insecticidal properties and was nontoxic to several types of cancer and HIV-infected cells. Scientists have applied for a patent. *For more information, contact Robert A. Moreau, (215) 233-6428, Plant Science and Technology Research, Philadelphia, PA.*

Bone Density and Race

Women who carry a genetic marker for low bone density already have less dense bones in their twenties and thirties than women without the marker. That's the finding of a study of 155 black and white women age 20 to 40, and it agrees with what has been seen in women past menopause. Because low bone density can lead to osteoporosis, the finding points to the need to identify girls with this marker early in life so that steps can be taken to help them reach their maximal bone density.

The marker, discovered last year by Australian scientists, is a mutation in a gene that makes a protein which regulates the way the body uses calcium. Women with two copies of the marker (one from each parent) had between eight and nine percent less bone density in the hip and 6.4 percent less in the spine than those with only one or no mutation.

The study also dispelled the notion that this trait might explain why blacks generally have denser bones than whites. The percentage of black and white women with the genetic marker was about equal. Researchers are now testing to see if people with the genetic marker don't adapt to low calcium intakes—common in this country. This could help explain their low bone density. *For more information, contact James C. Fleet, (617) 556-3186, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA.*

Black girls absorb calcium more efficiently and form new bone at a faster rate than their white counterparts. This difference in calcium absorption during childhood and adolescence may explain why black women tend to have lower rates of osteoporosis later in life: They begin with stronger bones. In the study of 89 girls between the ages of 5 and 16, researchers found the greatest difference in absorption rates after the onset of puberty. But black girls consistently demonstrated more bone-forming activity throughout childhood and adolescence. The finding suggests that recommended intakes of calcium may need to be tailored to particular groups.

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However, while the black girls absorbed more calcium, none of the girls in the study met the recommended intakes. Current recommendations based on a recent National Institutes of Health panel specify three to four servings of calcium-rich foods for children ages 6 to 10, increasing to four to five servings at age 11. A serving could be one cup of milk, an eight-ounce container of yogurt or 1-1/2 ounces of natural cheese. *For more information, contact Steven Abrams, (713) 798-7000, Children's Nutrition Research Center, Houston, TX.*

Body Shape Weighs Into Weight Loss

Women shaped more like an apple than a pear may have more difficulty losing weight. In studies of 22 women, those with more fat around the waist than the hips and thighs—the apple shape—lost about eight percent of their body weight. That compared to an 18 percent loss in those with larger hips and thighs compared to the waist—the pear shape.

Using sophisticated x-ray equipment, the researchers also corroborated what others have observed in larger studies using simpler equipment: Weight loss did not change the waist-to-hip ratio. The women's basic shape remained the same. Since numerous studies have associated the apple shape with a higher risk of cardiovascular disease, diabetes and even cancer, the findings question whether a weight-loss regimen alone will substantially reduce risk. This study combined regular aerobic exercise with a 50-percent calorie cut for optimal weight reduction. Nearly all the weight lost by the women in both groups was in body fat, not in muscle. *For more information, contact William A. Siders, (701) 795-8430, or Henry C. Lukaski, (701) 795-8429, Grand Forks Human Nutrition Research Center, Grand Forks, ND.*

Extra Vitamin D Slows Bone Loss

Is 200 International Units (IU) of vitamin D—the current Recommended Dietary Allowance—enough to minimize bone loss in older women? The latest study suggests that more is better for protecting the hip—at least in the Northeast where sunshine is sparse during the colder months. Sunlight prompts the skin to manufacture its own vitamin D. During the two-year study of 261 women living in the Boston area, half of the volunteers consumed 200 IU of vitamin D daily, while the other half got 800 IU. And all were given extra calcium during the study to ensure optimal intake.

The group on the higher vitamin D intake lost one percent less bone at the hip during the first year and 0.5 percent less in the second compared to those getting the RDA. Seventy percent of the benefit occurred in the winter-spring months when the sun's rays are weakest and exposure is infrequent. Trouble is, the women's average vitamin D intake was only half the RDA before the study began.

Slowing bone loss at the hip—actually, the top of the thigh bone where it fits into the pelvic girdle—could spare many elderly people from a painful disability. The hip is the

leading site of fractures in the elderly. Good sources of vitamin D include fatty fish, egg yolks, milk—because it is fortified with the vitamin—and fortified breads and cereals. *For more information, contact Bess Dawson-Hughes, (617) 556-3066, USDA Jean Mayer Human Nutrition Research Center on Aging at Tufts, Boston, MA.*

Protein Needs for Elders

Older women had a significant drop in lean body mass, in muscle function and in the ability to fight off infection when their protein intake was only about half the Recommended Dietary Allowance. For a 140-pound woman, the RDA is 50 grams per day. While most Americans consume more than enough protein, some 10 to 20 percent of women over age 55 get less than 30 grams daily. That's about the amount in half a chicken breast, in a three-ounce can of tuna or in two cups of dried beans.

Researchers wanted to see if such a low-protein intake would compromise a woman's immune response as well as her ability to get around and perform normal tasks. Six volunteers over age 66 ate about half the RDA for protein for nine weeks, while six others got a little more than the RDA. The women getting half the RDA lost an average eight percent of lean tissue, most of which was muscle. The amount of weight they could push in a chest press exercise dropped by 12 percent. And one measure of immune response—a hypersensitivity skin test—was 50 percent lower by the end of the study.

By contrast, the six women getting ample protein had no changes in muscle mass. Moreover, several measurements of muscle function and immune response improved significantly as did several blood protein measurements, suggesting that their diet prior to the study may have been a little low in protein. *For more information, contact Carmen Castaneda, (617) 556-3142, or Marilyn C. Crim, (617) 556-3095, Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts, Boston, MA.*

Measuring Water Weight Gain Easily

Obstetricians may someday measure water weight gains of pregnant women without having to take a blood sample. A study by University of California at Berkeley and ARS scientists may be the first to explore this specialized use of a technique known as bioimpedance spectroscopy, or BIS. Water is the biggest portion of pregnancy weight gain. Its buildup outside cells can lead to painful swelling that can elevate blood pressure and cause other complications.

In tests of 10 pregnant women, ages 20 to 37, BIS proved to be faster and easier than the sodium bromide technique for estimating water outside and inside cells. And it was just as accurate. BIS measurements take only two minutes and—unlike the sodium bromide technique—require no blood samples.

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The bioimpedance instrument sends a harmless sweep of currents through electrodes at the hand and foot. The device distinguishes differences in resistance as the electricity travels easily through water or is impeded by cell membranes. Via computer link, bioimpedance measurements are turned into estimates, on a printout, of the total amount of water in the body, plus the amounts outside and inside cells. *For more information, contact Marta D. Van Loan, (415) 556-5729, Western Human Nutrition Research Center, San Francisco, CA; or William W. Wong, (713) 798-7168, Children's Nutrition Research Center, Houston, TX.*

Barren Insect Pests

A virus that causes sterility in corn earworms could give farmers an environmentally safe weapon against this scourge of corn, cotton and other crops. Also, the virus may have potential to knock down related pests, such as the legume podborer, tobacco budworm and fall armyworm. Together, these pests cause an estimated \$5 billion in damage to various crops throughout the world. The virus, called gonad specific virus, attacks the corn earworm in its moth stage and infects only the moth's reproductive system, deforming either ovaries or testes. Most infected moths lack reproductive organs altogether.

Based on lab studies, scientists estimate that low levels of the virus cause sterility in 70 to 80 percent of infected moths. The rest become carriers, passing the virus along to the next generation through mating. Field tests of the virus are planned for later this year. ARS has filed a patent application on the virus. *For more information, contact Ashok Raina, (301) 504-9396, Insect Neurobiology and Hormone Lab, Beltsville, MD.*

Crisper Apples Sooner

High-quality apples now reach consumers sooner because of advances in storage techniques. ARS scientists proved to Washington state officials that Gala and Jonagold apples need be kept only 45 days in controlled atmosphere (CA) storage to meet state requirements. Previously, 90-day storage was required. CA storage means low levels of oxygen, high levels of carbon dioxide and cool temperatures. This slows an apple's natural "breathing" rate. CA apples stay firmer, crisper and tastier than apples stored in traditional cold rooms. Now the researchers are studying ways to improve the keeping quality of apricots, which can't be stored for more than a few weeks. *For more information, contact Stephen R. Drake, (509) 664-2280, Tree Fruit Research Laboratory, Wenatchee, WA.*

A-Peeling Citrus

Prepeeled oranges and other citrus could soon be making their debut in restaurants and school lunch programs. Prepeeled Fruit, Inc., of Groveland, FL, has been licensed to

use ARS-patented technology to remove citrus peels with commercially available food-grade enzymes. That eliminates hand peeling and allows more precise portion control. Also, the process removes the bitter white portion of grapefruit peel. Prepeeled Fruit, Inc., incorporated the technique in a new processing plant in central Florida. The plant can process about 50,000 pounds—about 100,000 pieces—of fresh fruit each eight-hour shift. *For more information, contact Robert A. Baker, (813) 293-4133, Citrus and Subtropical Products Laboratory, Winter Haven, FL.*

Fungicide-Free Fruit

Microorganisms are key ingredients in two new products registered by the U.S. Environmental Protection Agency as the first postharvest biofungicides. Cooperative research and development agreements between ARS and two companies resulted in these natural components being used to control rot in stored fruit. ECOGEN of Langhorne, PA, made ASPIRE from the yeast *Candida oleophila*, found on tomatoes. Patented by ARS and Israeli scientists, the yeast combats postharvest rot on citrus and apples.

EcoScience of Worcester, MA, developed BIO-SAVE 11 from *Pseudomonas syringae*, a bacterium that fights rot on apples, pears and citrus. This organism was isolated from the surface of apples and is being patented by ARS. California's Environmental Protection Agency concurrently registered BIO-SAVE 11 as a biofungicide. The current worldwide market for citrus postharvest treatments is about \$18 million a year; \$8 million for apples. *For more information, contact Charles L. Wilson or Wojciech J. Janisiewicz, (304) 725-3451, Appalachian Fruit Research Laboratory, Kearneysville, WV.*

Grapes Get Disease-Resistant Gene

A new gene has been successfully inserted into Thompson seedless grapes—a scientific first. ARS scientists and collaborating university researchers hope the gene will give built-in protection against a common grape virus. This genetic engineering advance could decrease economic losses to grape crops and reduce the amount of chemicals put into the environment. It paves the way for plant breeders to improve disease and insect resistance of all major grape varieties. Healthy, genetically transformed Thompson seedless grapevines are growing in ARS greenhouses in Kearneysville, WV. Scientists from the University of Florida and Cornell participated in the research. *For more information, contact Ralph Scorza, (304) 725-3451, Appalachian Fruit Research Station, Kearneysville, WV; or David W. Ramming or Richard L. Emershad, (209) 453-3160, Horticultural Crops Research Laboratory, Fresno, CA..*

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